Cold Climate Housing Research Center

CCHRC

Hybrid Micro Energy Program
Award No. 01163
Quarterly Report: January 1, 2011 to March 31, 2011

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Per the terms of the Hybrid Micro-Energy Program (HMEP) grant agreement, the three priority renewable energy systems to be evaluated are:

A small scale biomass combined heat and power (CHP) system that can convert wood into heat and power for use in small scale loads including residences, small community facilities, and potentially small communities and/or neighborhoods.

CCHRC has used a variety of methods over several years to search for, identify, and procure a small-scale biomass CHP unit that shows promise of meeting the practical and economic demands in Alaska. While CCHRC remains hopeful that a promising small-scale biomass CHP unit will emerge that merits testing and application, CCHRC is going to focus its efforts in this area of the grant award on preparing a report documenting our findings and experience related to the small-scale biomass CHP industry.

A ground source heat pump project that includes solar thermal collection to recharge the ground

During the 1st quarter of 2011 CCHRC and the Fairbanks North Star Borough School District finished installing most of the hybrid heat pump system. All of the plumbing and most of the electrical parts of the system are in place. Figure 1 shows installed heat pump.

Figure 1. Weller Heat Pump. The heat pump itself is the brown box on the silver legs. The ducts move cold air from outside through the heat pump and put warm air into the building.

The monitoring sensors are installed in the piping and ducts and just waiting for power. Once the electrical installation is finished the system will be commissioned, which could happen by the end of April.

The school district has agreed to wait on using the solar panels to charge the ground for one year. This delay will enable CCHRC to research how much efficiency the solar panels add to the heat pump system when they are brought online in one year.

CCHRC is interested in extending the evaluation period of this project in light of recent findings from a ground source heat pump report relating to application in cold climates which indicates that there is a need for long-term performance evaluation.

A combined solar photovoltaic (PV) and wind system integrated into an energy efficient load design.

The Denali Commission funding is being utilized to monitor and report on the performance of a combined solar photovoltaic (PV) and wind system installed at the Anaktuvuk Pass house (a Sustainable Northern Community prototype house). The power systems were funded by the Yukon River Inter-Tribal Watershed Council (YRITWC), who is also a partner in the overall evaluation of the alternative energy systems. GW Scientific and Campbell Scientific are providing in-kind matching support. CCHRC, YRITWC and GW Scientific comprise the main

technical interpretative team. Remote Power Inc. has been providing valuable in-kind matching technical support related to the wind and solar power systems.

2011 first quarter activities included a January 2011 site visit to perform some improvements in the house building systems. The solar system started providing measurable power to the residence in February. Figure 2 shows the location of the house and its orientation relative to other homes in the Anaktuvuk Pass subdivision. Figure 3 shows panels in their adjusted vertical orientation. This orientation not only helps shed snow cover, but also allows the reflected solar radiation from the snow pack in front of the house to have more direct affect on the solar panels.

The hybrid power system is helping reduce the electricity demand from the village utility grid and continues to serve as a platform for community residents and other villages in the North Slope Borough to learn about renewable energy. Figure 4 shows some of the data from the solar system and the impacts of winter and solar conditions on solar panel power generation during the 2010/2011 winter season. Data collection from the Fronius inverter was started during late April 2010. The final project report will discuss the factors impacting solar power generation in Anaktuvuk Pass and lessons learned. The combination of renewable energy systems and energy efficiency at the Anaktuvuk Pass prototype home is serving as an active demonstration of possibilities in sustainable northern communities, while simultaneously serving as a valuable research platform to help determine not only how the technology works, but what training and background residents need to help maintain renewable energy solutions.

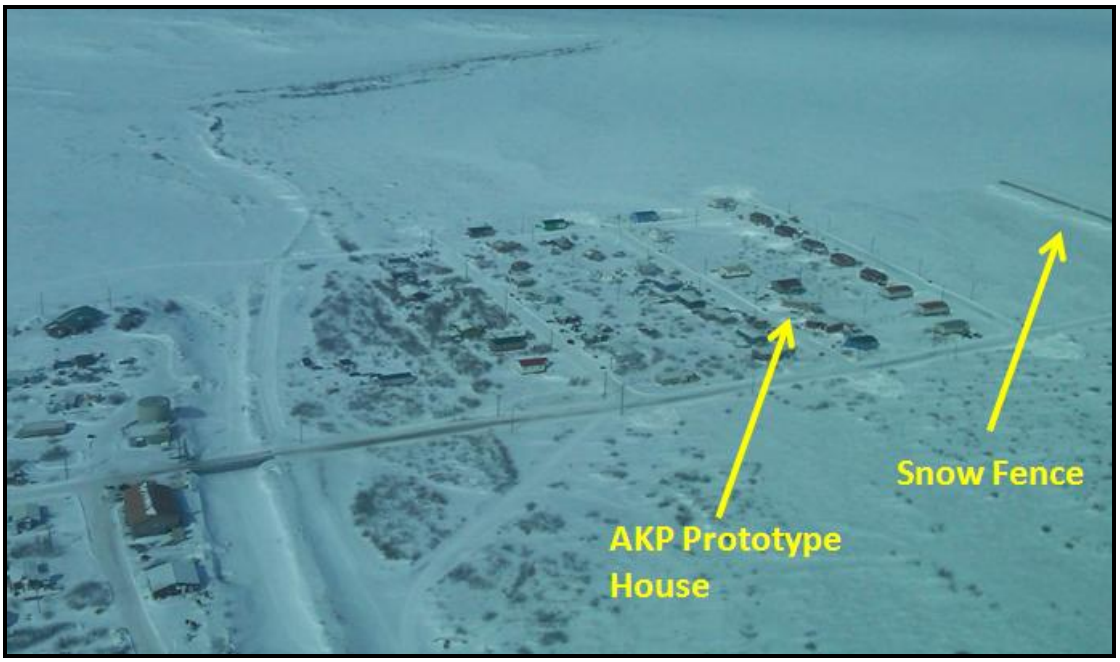

Figure 2. The Anaktuvuk Pass house is orientated to reduce snow drifting at the front of the house and to take advantage of passive solar resources. This varies from the standard orientation of other homes in the subdivision. This is part of accessing the environment when designing sustainable northern shelters. (photograph by M. Lilly, April 21, 2011)

Figure 3. The solar system has had the panels adjusted to be as vertical as possible and snow/ice removed. This orientation has resulted in snow-free conditions in the spring. (photograph by M. Lilly, April 20, 2011).

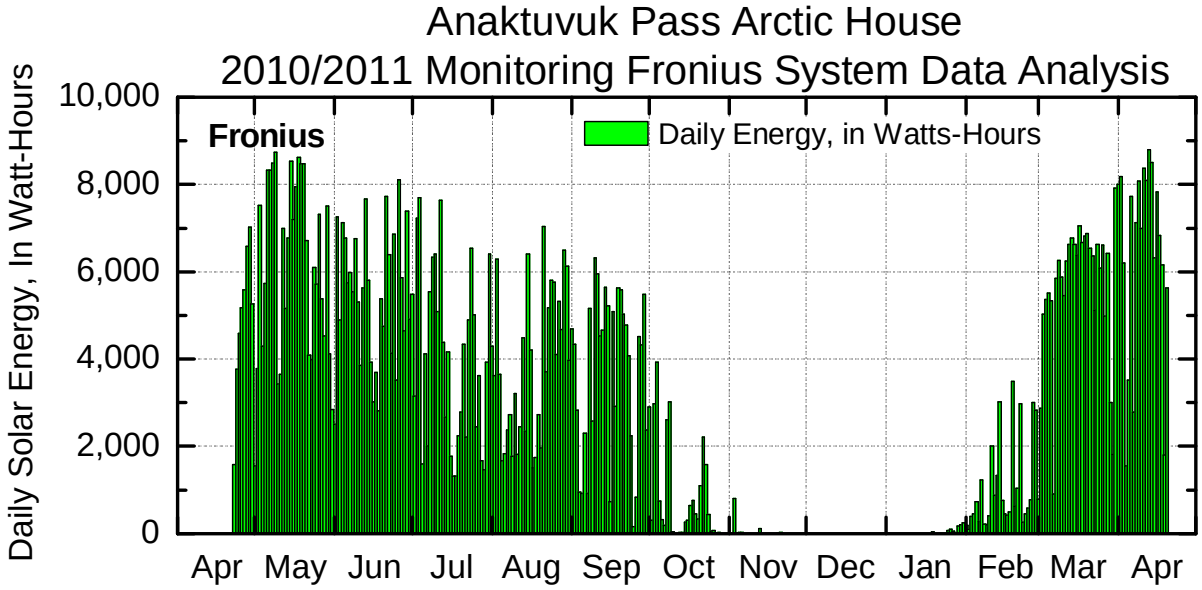

Figure 4. Solar panel output measured by the Fronius inverter. There is approximately a 2 month period in the middle of winter with no solar input.